REMARKS

Claims 1, 3, 7, 9, 10, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 73, 75, 77, 78, 93-116 are all the claims pending in the application.

This Amendment amends claims 1, 3, 9, 10, 13, 19, 33, 35, 37, 39, 41, 43, 57, 59, 77, and 78, adds claims 93-116, cancels claims 2, 4, 6, 8, 11, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60-72, 74, 76, and 79-92, and addresses each point of objection and rejection raised by the Examiner. Favorable reconsideration is respectfully requested.

New dependent claims 93-105 are directed to the elected species. Claims 106-116 are a new set, and are submitted as being generic, covering both the elected and un-elected species.

Applicant thanks the Examiner for acknowledging the claim for foreign priority under 35 U.S.C. § 119, noting that the priority documents have been received, and initialing the Information Disclosure Statement filed January 27, 2000.

I. Claim Objections

Claims 57-61, 63, 65-69, 71, 77-82, and 85-90 are objected to under 37 C.F.R. § 1.75(c) as being in improper form. These claims have been amended or cancelled. The amendments are believed to overcome the objection. Reconsideration and treatment on the merits are respectfully requested.

II. Allowable claims

Claims 13, 15, and 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Applicant appreciates the indication that these claims would be allowed if rewritten in independent form, and has amended claim 13 accordingly. Additionally, claim 13 is amended to supplement the description of the reflections. Entry and consideration are requested.

III. Rejection under 35 U.S.C. § 102 over U.S.P. 5,841,496 to Itoh et al. ("Itoh")

Claims 1, 3, 5, 9-10, 19, 21, 23, 25, 27, 33, 35, 45, 47, 49, 51, 53, 55, 73 and 75 have been rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Itoh.

Applicant has amended claims 1 and 3 to require a relationship between the helix pitch and the white light. Specifically, claims 1 and 3 now require that the white light comprises a plurality of wavelengths, wherein $p \cdot \cos\theta = \lambda/n$, p being the helix pitch, θ being an incident angle of said white light on the said liquid crystal layer, λ being a wavelength of said plurality of wavelengths of said white light, and n being an average refractive index of the liquid crystal.

Itoh discloses a reflective liquid crystal display that is said to provide an improved viewing angle, high luminance, and no "dark display shadows." Itoh is a variation on a conventional "twist" reflective LCD panel. The liquid crystal layer 10 is placed between an upper polarizer 13 and upper orientation layer11, and lower orientation layer 21 and a lower polarizer 23. The upper and lower orientation layers physically orient the molecules of the liquid crystal to form a "twist" of the birefringent liquid crystal, so that light polarized by the upper polarizer is re-oriented for the lower polarizer, as is well known in the art.

Specifically, linearly polarized light having the orientation of a first polarizer lines up with the orientation of the liquid crystal closest to that polarizer. As the light travels toward the opposite polarizer, the polarization of the light twists in accordance to the changing orientation of the intervening liquid crystals. The orientation layer proximate to the opposite polarizer aligns the light to transmit through the polarizer. If the light had retained its original polarization, as dictated by the first polarizer, it would be blocked by the second polarizer.

For example, Itoh discloses at column 15, line 40 that a 240° twisting angle is utilized. Thus, as travelling through the liquid crystal layer, birefringent molecules arrange themselves between the orientation plates to twist the light around 240° as it passes through the liquid crystal. This twisting angle is dictated by the orientation of the polarization plates (typically having perpendicular linear polarizations as indicated at column 6, lines 14-16 of Itoh), the liquid crystal used, and the distance between the orientation plates.

By applying an electric field to the liquid crystal, the orientation of the liquid crystals is altered, interfering with the polarization twist of light passing therethrough, whereby the light polarized by one polarizer is no longer re-oriented for transmission through the other polarizer. Light transmission is thereby controlled.

The helix pitch as utilized in the present invention is completely different than the twist in a conventional display. Differences will be explained below, in the discussion of the claims.

Applicant respectfully submits that the reference does not disclose all the features of the claimed invention.

For example, claims 1 and 3 now require $p \cdot \cos\theta = \lambda/n$. Itoh neither teaches nor suggests this requirement. Rather, Itoh emphasizes colorless display, describing coloration induced by the liquid crystal as the problem to be solved. *See* column 3, line 45 to column 4, line 52.

Further, claim 1 requires that the at least one flat mirror reflects incident light transmitted through the liquid crystal layer toward the light source. This feature is not taught by Itoh. Rather, the mirror of Itoh directs incident light toward a viewer, not the light source. There is a 20° difference between the direction of the light source and the direction of the viewer, and the viewing angle has ±10°. *See* column 5, lines 21-30. Moreover, one of ordinary skill in the art would not be motivated to modify Itoh to reflect to the light source instead of the viewer, as it would reduce the light reaching the viewer.

Similarly, claim 3 requires a first flat mirror to reflect the incident light transmitted through the liquid crystal layer in an incident direction thereof, and a second flat mirror for reflecting the light reflected by the first flat mirror and by the liquid crystal layer in the incident direction thereof. Itoh discloses a directional reflector 31 having a plurality of fine reflecting faces which are inclined. Neither the reflecting surface, nor the second surface which the Examiner argues is inherently a second reflector, is intended to reflect light back in the incident direction (*i.e.,* back in the direction from which it came).

The Examiner asserts that since ambient light is used, light would inherently be reflected off of one mirror toward the other mirror. The claim requires that the second flat mirror reflects light reflected by the first flat mirror *and* the liquid crystal layer. Further, the claim requires that there be a white light source, sending white light onto a surface of the transparent substrates in an

oblique angle. Thus, the light described in the claim is not any ambient light (*i.e.*, not light with normal incidence to the substrate). Looking at Fig. 1 of Itoh, the only circumstance where the vertical surface of the reflector would reflect light back in the incident direction is light that was normal to the structure; such light not meeting the express requirement of the claim. Moreover, the vertical surface is not arranged to reflect light reflected by the liquid crystal layer back in the incident direction thereof. Similar, looking at the reflectors in Figs. 10(a)-(i) of Itoh, there is no suggestion of a structure to reflect light off two surfaces, *each* surface reflecting in the respective incident direction.

Applicant submits claims 5, 9-10, 19, 21, 23, 25, 27, 33, 35, 45, 47, 49, 51, 53, 55, 73 and 75 are also not anticipated, at least as further limitations on claims 1 an 3.

Additionally, claims 9 and 10 have been reworded. Reconsideration is requested.

Additionally, claim 19 has been amended to supplement the description of the reflections. Applicant understands the Examiner to be arguing that white light comprises at least some circularly polarized light. Even if this were so, there is no disclosure in Itoh that supports the inherency of overlapping optical paths of the two reflected circularly polarized light beams.

Itoh does not utilize the wavelength-selective reflection properties of liquid crystal having a helix pitch (for a general explanation of this phenomena, consider Figs. 2A-2I of the present application). Rather, Itoh emphasizes colorless display, describing coloration induced by the liquid crystal as the problem to be solved. *See* column 3, line 45 to column 4, line 52. Moreover, coloration in Itoh is not the result of wavelength-selective reflection, but rather, is a byproduct of utilizing double refractivity. That is, the variations in color in Itoh are interference

colors. There is no discussion in Itoh of circularly polarized light, a circularly polarized light beam, nor of selective reflection by the liquid crystal. Itoh would regard such reflection as unwanted coloration to be eliminated (*see* Itoh's Background of the Invention).

Supporting that Itoh does not use helix pitch to achieve wavelength-selective filtering, to achieve selective coloration of the reflected light, Itoh adds a color filter 50. *Compare* Figs. 2 and 3, and *see* column 25, lines 1-2; *see also* color filter 51 in Fig. 27.

Absent properly aligned reflectors and selective reflection by the liquid crystal, there is absolutely no basis for concluding that there would be overlap of the optical path of a light initially reflected by the liquid crystal and a light reflected by the reflector.

Further, regarding claims 21 and 23, the Examiner appears to rely on the refractive index of layer 53 in comparison to the liquid crystal layer as basis for the rejection. While Itoh discloses a refractive index for the epoxy resin smooth layer 53 (*see* col. 22, lines 35-36; col. 23, lines 26-28) and the phase plate (*see* col. 18, lines 57-64), Applicant sees no disclosure in Itoh of the refractive index of the liquid crystal material. Reconsideration of the rejection of claims 21 and 23 is requested.

Further, regarding claims 53, 55, 57, and 59, Itoh discloses only a single element including liquid crystal, operating so as to vary double refractivity between polarizing plates. In comparison, these claims require both the liquid crystal layer of the optical modulation element and a liquid crystal display element having a shutter function. Accordingly, claims 53, 55, 57, and 59 are not anticipated.

Further, regarding claims 73 and 75, the examiner asserts that Itoh performs field sequential display. Applicant respectfully submits that the Examiner is mistaken, as Itoh is completely incapable of field sequential display. Rather, Itoh uses spatially adjacent filters. *See* color filter 50 in Fig 3 *with* column 25, lines 1 and 2; Fig. 17 *with* column 8, lines 12-14 and column 25, lines 32-42; color filter 51 in Fig. 27 *with* column 25, lines 26-31. Field sequential displays, as discussed in the Background of the Invention of the present application, require a sequence of colors to be alternately generated for a same display field. The spatial filters used designs like Itoh are a completely different approach. For example, in a full color field sequential display, the smallest picture element can provide time-averaged full color. In comparison, in with a spatial filter, the smallest picture element can produce only a fixed single color, and it takes spatial-averaging to produce full color.

IV. Rejection under 35 U.S.C. § 103(a)

Claims 7, 29, 31, 37, 39, 41 and 43 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Itoh.

Applicant submits that claims 7, 29, 31, 37, 39, 41 and 43 are not obvious at least because claims 1 and 3 are not obvious. As explained above, one of ordinary skill in the art would not be motivated to modify the reflectors of Itoh to reflect light as required by the claims, nor utilize a helix pitch in accordance with the claimed equation.

V. New Claims

Applicant adds new claims 93-116. No new matter is added.

Many of these claims further highlight the differences between the wavelength selective reflection phenomena utilized by the present invention and Itoh. For example, dependent claims 93 and 95 require that the optical modulation element does not include a polarization plate. In comparison, Itoh requires polarizers in order to operate. Elimination of both polarizers in Itoh would render the LCD inoperative.

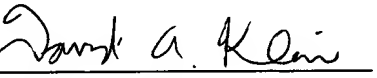
Entry and consideration of these new claims are respectfully requested.

VI. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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